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COUNTRY PROFILE: ITALY
PLANT GENETIC RESOURCES ASSESSMENT AND PRESERVATION IN ITALY

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ABSTRACT

An overview of the plant genetic resources status and conservation activities ongoing in Italy is given in the present report. Both *ex situ* and *in situ* initiatives are reviewed, with the indication of the single institution involved or in charge of each action. Some activities have been conducted for many years now, other ones are rather new and as susceptible of improvement, according to possible future developments. In particular some actions aimed to *in situ* conservation of agricultural resources might be boosted in the next years as a result of possible expansion of specific programmes regarding on-farm conservation in peculiar areas, such as the minor islands of Sicily. An indication is also given on the first initiatives undertaken to implement the convention of Rio in Italy. The Italian Academy of Science has developed, as the first step, the Italian Global Plan, which will be probably accomplished through interaction with the Ministry of the Environment.

KEY-WORDS

PLANTS. GENETIC RESOURCES, ITALY, EX SITU, NOTANIC GARDENS, ARBORETA, PROTECTED AREAS

MOTS-CLEFS

PLANTES, RESSOURCES GÉNÉTIQUES, ITALIE, EX SITU, JARDINS BOTANIQUES, ARBORETA, AIRES PROTEGÉES

PLANT GENETIC RESOURCES IN ITALY

The Mediterranean region is the centre of origin of several crop species and an important centre of diversification for introduced species. Many wild relatives of crops are present in this area and many wild plants are used as source of food or for other uses (Pignatti 1982). Unfortunately, most of this diversity, constructed over the centuries, has been subjected to vast levels of genetic erosion. The explanations for this circumstances are several: the increased level of urban spreading, the destruction of natural environments, due to the increased human activity consequent the expansion of the consumes, the changing socio-economic conditions, the rapid spreading of few modern varieties etc. (Pignone 1990, 1997).

In Italy, as in the other Mediterranean highly industrial countries this situation has reached dramatic levels. From a geographical point of view, Italy is highly differentiated for ecological, pedoclimatic, and orographic features. As a result the Italian flora is rich of endemic and rare plants (Pignatti 1982) and many crops have their original domestication centre in Italian regions or differentiated to specific entities in Italy: for many cultivated species there are Italian genotypes or land-races representing a genetic 'uniqueness' in the germplasm of that species (Hammer & al. 1992).

Some data may help in understanding the importance of the problem and the several activities to try limit the damages of such genetic erosion. In the last twenty years, exploration missions carried out for collecting and preserving old wheat varieties have shown that only 1-2 % of the traditional varieties were still under cultivation (Perrino 1988, 1992a).

Not all species have such a dramatic recent history as wheat. In the case of vegetable crops genetic erosion has been less extreme, especially for those species that have not been subjected to a great extent of domestication but still retain many of the features of the wild forms from which they derive. This may be the case of *Taraxacum officinale*, which is cultivated but at the same time is also gathered from the wild; moreover the fact that these species have a reduced level of domestication allows gene exchange with the wild relatives growing in the area, thus continuously introducing wild traits into the cultivated germplasm (Perrino 1994). On the basis of these considerations, the risk of genetic erosion seems to be lower for vegetable crops than for cereals. However due to the introduction and spreading of hybrids this situation is rapidly changing, and in addition to the fact that in the past, scientists paid less attention to preserving this species poses a high question on vegetable crops.

Another example might be that of fruit trees. A very high number of varieties were developed through the centuries all over the peninsula for many different species. In some cases the domestication was very slight, as in the cases of *Myrtus communis* or *Arbutus unedo*. In other cases the interaction with the wild has been much stronger. As an example, it is a long lasting tradition of shepherds to graft wild pears with cultivated stocks, so as to provide themselves with a reservoir of their preferred fruit over their wandering (Hammer *& al.* 1992, Pignone *& al.* 1997). This heritage has also been very much eroded, although quite a few specimens of traditional varieties still survive, here and there, in several regions of the peninsula, often as the result of the efforts of single amateurs rather than of the institutions (Perna & Della Ragione 1992).

PROJECTS AIMED TO PRESERVING GENETIC RESOURCES

Unfortunately Italy lacks of an organic scheme or a co-ordinated activity for plant genetic resources preservation. Several initiatives have been started by both institutional organisations, professional associations and NGOs. Just to give a few examples, the Italian Botanical Society has allocated some funds for an inventory of some rare plants of the Italian flora. The project is still in its initial stage and, to the authors' best knowledge, no practical action has been undertaken until now. Also the Italian Society for Agricultural Genetics has started a working group on 'plant genetic resources' with the aim of promoting co-operation between research groups conducting research activity on genetic aspects of PGR conservation, evaluation and use.

Besides the lack of co-ordination, the activity of PGR preservation started very early this century. Later on, around the 1960s, when the awareness on the risk of loss of genetic diversity arose in the scientific community, a greater effort was started. At that time breeders were engaged in producing new well adapted varieties which could compete on the international market with foreign ones and the necessity of a genebank became sharper in order to conserve the traditional varieties and landraces and preserve their genes from disappearance.

At present, PGR programmes in Italy include *ex situ* (the majority of the activity, including collection, multiplication, characterisation, evaluation, documentation, distribution and utilisation of genetic resources) and *in situ* conservation actions (Leipzig Conference 1996).

EX SITU CONSERVATION

Ex situ conservation, is mainly carried out in seed genebanks, field genebanks, botanical gardens, alpine gardens, and arboreta.

Seed genebanks

In 1970, the National Research Council (CNR) established in Bari the Laboratorio del Germoplasma with the main aims of collecting and preserving plant genetic resources of interest to Italian and Mediterranean agriculture. In 1980, due to the increased activity, especially in research fields, the Laboratorio del Germoplasma was transformed in a research Institute. Presently ten researchers and several technicians and operators, for a total of nearly forty staff members, are engaged in the activities of the Istituto del Germoplasma (IdG).

Thanks to many exploration and collecting missions, carried out in different regions of Italy, Mediterranean countries, Ethiopia and Southern Africa (Perrino & Porceddu 1990; Perrino *& al*, 1990; Perrino, 1991; Hammer *& al*, 1992), the IdG has collected and stores nearly 13 000 accessions of various species. In addition to directly collected materials other samples were obtained through exchange with other research centres and genebanks all over the world. The number of accessions stored at the Germplasm Institute approaches 56 000 samples to which some sub-samples needed to preserve rare genotypes have to be added. The collection represents more than 40 genera and approximately 600 different species. More than 30 000 accessions of *Triticum* spp. stored in Bari, indicate that the Germplasm Institute, together with the National Seed Storage Laboratory of ARS-USDA in Fort Collins (Colorado, USA), the Institute for Plant Industry N.I. Vavilov of the Academy of Science of CSI (St. Petersburg), and the Department of Genetics of the University of Kyoto (Japan), is responsible for the safeguard of a duplicate of the wheat world collection.

The information collected during exploration, characterisation and evaluation programmes, are filed in special databases of the Institute. At present the IdG is trying a transition from a more traditional data retrieval system to a more modern one, able to interface to the networks. The future goal is to produce interactive databases that can be updated directly by the users any time new information becomes available. An experimental prototype is already active with a limited number of features, but other experiments are being carried out.

Of course the main activity of the IdG was carried out in the area of cultivated species and only rarely wild crop relatives or wild useful species were collected. Nevertheless in the last decade there was an increased awareness of the importance of wild useful species. Collecting campaigns were planned for specific wild species as for *Brassica*s (1982–986), *Beta* (1985), wild relatives of wheat (*Aegilops, Agropyron, Dasypyrum* etc.,1987–990), *Eruca* (1994–present). All these genera encompass both species directly used by people, species with desirable traits to be possibly transferred to crops and species whose crop potential has not been exploited yet.

Besides the Germplasm Institute, there are in Italy at least other 30 institutions that maintain seed germplasm collections, but with different purposes. In most cases these institutions are committed to one or few species, and in many cases they only store working collection. Altogether, it is possible to count 55 genera, 137 species of crops and wild relatives, and more than 60 000 samples. With the exclusion of the wheat world collection, the collections are generally small or relatively small ones. The effective total number of accessions stored as seed collections in Italy can be estimated at roughly 70 000 samples with the exclusion of germplasm used and maintained by commercial seed companies.

Field genebanks

In the field of conservation of germplasm of perennial and vegetatively propagated crops, wood and fruit trees, Departments at different Universities, the Ministry of Agriculture (MiRAAF), the National Research Council and many other formal and informal organisations have played an important role.

In 1981 a national Working Group devoted to the 'Protection of Genetic Resources of Arboreal Fruit Species' was established by the National Research Council. The Group, while interacting with the ECP/GR European Working Groups, brought together the major national fruit tree research institutions. Each of them takes care of the conservation of different species depending on the region in which they are located. As a result of this activity, carried out for several years, there are at least 18 Institutions involved in the preservation of 14 genera of fruit crops, including 46 species and more than 14 000 samples. In particular, there are 43 stations conserving arboreal germplasm (6 for olive, pear, and apple, 5 for vines, 4 for peach, 3 for almond, cherry and citrus, 2 for apricot, plum and other species). The more important and spread out the species, the higher the number of the stations; in some areas the same Institution preserves different species located in different stations (Perrino 1990).

Notwithstanding the efforts to activate a co-ordination of the centres storing fruit germplasm, the number of stations and field collections might not be sufficient to preserve the variability still present in fruit tree species.

Botanic gardens

The first botanic garden in Europe was founded in Italy in 1545. The model was soon imitated by the main Universities and Courts of Europe. They became the meeting centres of plant explorers and scientists with the aim of improving knowledge of nature.

Today, in Italy there are 36 botanic gardens (BGs), 27 of which are managed by Universities (Raimondo 1992). Many field and greenhouse collections representing several thousands of species of different geographical origin are maintained on a limited surface. In fact the surface of each BG ranges from ca. 1,000 to 200 000 square metres, while the total surface all over Italy is 1 258 239 m^2 (ca. 1.3 km^2). Some botanical gardens are participating to an initiative, promoted by the Italian Botanical Society, aimed to create an interconnection of all BGs via the Internet. The initiative is still in its experimental phase but already some information regarding some Italian BGs is available at some URLs. At present, it is very difficult to state the exact number of species conserved in Italian BGs. Generally, the number of species present in each botanical garden ranges from very few to no more than 6,000 species.

Alpine botanical gardens

The first alpine gardens were founded in Austria, Switzerland and Bavaria in the 1800s. Numerous alpine gardens were created at the end of last century in several European countries with the aim of protecting alpine flora. Today in Italy there are 18 alpine gardens in the Alps, the Apennines and Etna mountain. The total surface is very limited, 422 000 m^2, but the number of protected species may be quite relevant.

Arboreta

One of the functions of the arboreta founded in the 1700s was education. More recently they have been used for the conservation of natural resources. In Italy there are only 4 arboreta with a total surface of ca. 1.8 km^2. In a limited area a great number of native species is conserved.

IN SITU CONSERVATION

In the last decade, under the influence of IUCN and with the support of WWF, many natural reserves have been established. The aim is to preserve populations representative of different ecosystems, often including agricultural systems and cultivated plants. For this kind of conservation, the main problem is to determine the minimal size of the populations which will

not endanger genetic structure and stability. To this end the knowledge of the genetic structure of the population is imperative.

Fruit and perennial crops

In situ conservation is an elective method for fruit trees, pasture species and wild relatives. A first step for setting up protected areas (reserves, national parks and biosphere) is to prepare a list of the species threatened of extinction and determine the areas in which the highest level of their genetic diversity is concentrated.

The above mentioned Working Group 'Protection of Genetic Resources of Fruit Arboreal Species' (WG) has played an important role also in the field of *in situ* conservation. In fact the WG has suggested to protect areas regarded as particularly rich in genetic variability from which experts are collecting materials for the field collections (Scaramuzzi 1988; Agabbio 1992). As a result of this activity the WG, in collaboration with technical agricultural schools, amateurs, botanical gardens, farmers, etc. has outlined at least 84 stations where ca. 8,800 traditional cultivars of 10 fruit species are protected by 24 different institutions. Amateur scientists and farmers played an important role in *in situ* or 'on-farm' conservation of old fruit crop germplasm (Perna and Della Ragione 1992).

Forest and perennial species

In Italy the total surface covered by forest trees is ca. 87 000 km^2, representing 29% of the total surface of the peninsula. Unfortunately until 1985 only 7% of the total forest surface, was subject to some degree of nature protection, such as parks, reserves, oases, etc.

National parks

There are 18 national parks in Italy covertng a total surface of 9,430 km^2. In these areas, several species are adequately preserved. However experts suggest that, if the objective is protection and conservation of existing species, in these areas human activities should be continued, exerting the same influence as in the past. The main limits of this kind of action are connected to the high costs, and the limited availability of large surfaces.

Biosphere reserves

This type of protected area is especially suitable for conserving wild relatives. The aim of a biosphere reserve is to conserve genetic resources and representative samples of the ecosystems; whatever the aim, education and training are priorities.

In Italy, in 1977 three biosphere reserves were established: Miramare (Trieste, c.0.60 km^2), Circeo (Latina, c. 32.60 km^2) and Collemuccio-Montedimezzo (Isernia c. 4.78 km^2). The protected biomes belong respectively to evergreen sclerophyllous forests (including coastal/marine component), evergreen sclerophyllous woodlands and mixed mountain systems with complex zonation. The first two biosphere belong to the Mediterranean Sclerophyll biogeographical province, while the third one belongs to the Central European Highlands one. Until now only Miramare has started monitoring and research on seawater chemistry, plankton, and experimental fish breeding.

On-farm conservation

In some Regions, amateurs and some private associations, in collaboration with local administrations, have recently started initiatives to promote conservation of landraces and ancient crops with the help of traditional farmers. The Germplasm Institute has been involved in

some of these projects regarding few ancient, neglected and under-utilised food crops. In some cases the initiative has been so successful that the model is going to be imitated by other traditional growers in marginal agricultural areas.

Some Regional governments are interacting with public research or academic institution to carry on projects concerning conservation and utilisation of threatened indigenous germplasm. These initiatives are in agreement with the EU regulation 2078/92 on the conservation, characterisation and utilisation of genetic resources in agriculture and other recent proposals for a sustainable agriculture. As an example the Region Basilicata, thanks to a collaboration with the IdG, was able to obtain the Indication of Protected Origin (EC reg. n. 2081/92, 14.07.92) for an ecotype of common bean from Sarconi (Brandi *et al* 1997). A similar proposal was done for some peculiar germplasm found in the island of Linosa (Hammer *& al* 1997).

OTHER ACTIVITIES

List of Italian spontaneous vegetables

A catalogue of wild plants of the Italian flora used as vegetables has been produced (1990) by Prof. Biancoof the University of Bari. This lists includes c. 250 taxa that are reported to be collected directly and used as similar cultivated species. The author stresses in the introduction the risk of over-collecting especially in some areas. Therefore this list might be used to construct a preliminary list of species needing special efforts for their conservation, although neglected by the academic or economic entities.

Database activity

During December 1996 a workshop on the 'characterisation and documentation of genetic resources utilising multimedia databases' was held in Portici. The aim of this workshop was to present a series of different approaches to the characterisation and documentation of genetic resources. Since several characteristics of a plants can be extracted from a visual inspection, the workshop organised two sessions, the first one devoted to the presentation of some systems for the documentation of genetic resources by means of images and the second one devoted to the presentation of some approaches to image analysis and processing.

The proceedings of the workshop are in preparation for publication and future activities were planned during the meeting. This initiative, to the authors' knowledge, represents the only Italian action aimed to the production of more advanced and user-friendly databases which can easily be interrogated and utilised by users with limited skill in informatics.

MEDUSA

Within the framework of the MEDUSA network, a preliminary list of species of interest has been compiled at the IdG. This list is based on the exploring and collecting investigation of the IdG performed in the first twenty years of activity. It principally covers the southern Italian regions and Sicily (Hammer *& al* 1992). This list, including over 1600 species, has been checked for wild species used by humans for different purposes. This examination has demonstrated that more than 130 species out of 1600 (less than 10%) are widely used for several different ends. Thirty-three are used for human food and thirty-five for animal food. Other two significant categories are plants used as food additives (22) and for different environmental uses (26). Therefore, altogether some 90 different species are used as food or food additive to men and animals; 55 of them (ca. 40% of the total) are directly used in human diet.

Aromatic and medicinal plants have not been included in that list since they deserve a special treatment and a careful check on their effective traditional use. In fact, the expansion of consumption of these plants has also brought along a new culture of the so called 'natural medicine'. This has led to the introduction of new species in the list of medicinal plants and nowadays it is difficult to define which were effectively used in the past and which are recent acquisitions. The issue is complicated by the fact that many medicinal plants are present all over the Mediterranean.

Other networks aimed to promoting the conservation of genetic resources

Underutilised Mediterranean Species.

In 1993, the International Plant Genetic Resources Institute (IPGRI) started a project on the Under-utilised Mediterranean Species (UMS), that is species which have a local importance but are underestimated by scientific and economic entities, and therefore not fully exploited in their potential. The project is co-ordinated by Dr. Stefano Padulosi, IPGRI, Regional Office for West Asia and North Africa, Aleppo, Syria.

In a first phase a questionnaire was sent out to several researchers in different countries asking them to indicate priorities on under-utilised species or species offering a potential economic value. The questionnaire was attempting to gather figures on the availability of genetic material and information, on the level of genetic diversity, on the evaluation of potential value, etc. As a consequence of this investigation four networks were established, dealing with pistachio nuts, hulled wheats, oregano and rocket.

The rocket network deals with species of *Eruca* and *Diplotaxis* growing both wild and cultivated in the Mediterranean basin; in Italy there is a non-scientific selection of *Diplotaxis* and *Eruca* species that are in the process of being domesticated. Rocket is a good example of plant with wide uses: it is used as a condiment and salad constituent, is a medicinal as well as an aphrodisiac plant, and, finally, it can be used as donor of useful traits to other cultivated *Brassicaeae* (Padulosi 1995).

A second meeting of the network was held at the University of Padua in December 1996. It was divided into two parts: during the first part, a general overview of past accomplishments of the network was made along with a discussion among the participants on on-going and future initiatives on rocket. The second part of the meeting was entirely devoted to the revision of the final draft of the '*Eruca* spp. Descriptor List'. Some information on the network are already available on the Internet and an on-line database of *Eruca* is scheduled to be established in 1997.

Network on Neglected Mediterranean Plant Genetic Resources of Landscape, Cultural and Artistic Value.

This network was established with the aim of promoting conservation and sustainable use of Mediterranean plant genetic resources having landscape, cultural and artistic value. The network is being supported by the SMED-CNR Office for Scientific and Technical Co-operation with Mediterranean Countries, in the framework of the project co-ordinated by Prof. Monti (University of Portici, Italy) on 'Plant Genetic Resources and Innovative Biotechnologies aiming at the increase of the value of Mediterranean Flora'; the support provided by SMED-CNR targets meetings organisation and training activities. The network wishes to promote conservation of plant genetic resources from a new angle, which has not so far received proper attention. It is one of the very few initiatives regarding non-food species.

The network operates through networking, which represent a cost effective way to join efforts. A national focal point for each country is nominated. Each national co-ordinator will co-ordinate own country participation to the initiative so to ensure a proper representation. A meeting every year is scheduled in Naples. Prof. Monti acts as network co-ordinator.

INC-CNR

The National Research Council of Italy (CNR) is subdivided into fifteen thematic Advisory Committees. The Advisory Committee on Agricultural Science has promoted the institution of three National Co-ordination Institutes (INCs). One of these INCs has in its scope the promotion of activity in field connected to genetic resources and biodiversity. At present one project in this area is active under the co-ordination of Prof. Monti. Some ten different operational units form part of this project, involving mainly institutes of the CNR.

Agreement with the Italian Ministry of Environment

The Convention on Biological Diversity was ratified by the Italian Government with the law no. 124 of 14 Feb. 1994. One of the implementations is to identify elements of the national biological diversity of interest for their conservation. On this basis, the Ministry of Environment has given IdG the assignment of supporting and co-ordinating an information system aimed at acquiring and distributing data regarding the genetic resources that constitute Italian biodiversity.

Within this framework, the specific assignments of the IdG are: 1. the management of some databases regarding Italian genetic resources, and 2. planning a campaign of initiatives aimed at increasing public awareness on themes regarding biological diversity.

Biodiversity, the Italian Global Plan

The objectives of the plan are to improve knowledge, utilization and conservation of biodiversity in Italy. It deals with the concept of and importance of biodiversity, tasks for Italy after the Rio Conference (UNCED) , biodiversity in Italy as compared with the rest of Europe, biodiversity and human activities, education, sustainable agriculture, management of biodiversity in relation to agriculture and many other activities, *in situ* and *ex situ* conservation, potential and risks of biotechnology and its impacts on the environment, particularly on biodiversity. The plan, ending with a list of international actions and cooperations, has been prepared by the Italian Academy of Science with the contribution of scientists in nearly all fields of science from Universities, National Research Council, Ministry of Research in Agriculture and Forestry, Non Governmental Organisations, etc..

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